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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/758,715	01/11/2001	Kenneth Lloyd Westra	THOLAM P139US	9530

20210 7590 08/11/2003

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EXAMINER

LAVARIAS, ARNEL C

ART UNIT PAPER NUMBER

2872

DATE MAILED: 08/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/758,715

Applicant(s)

WESTRA ET AL.

Examiner

Arnel C. Lavarias

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 June 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 45 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 45 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 18 June 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☒ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 6/18/03 in Paper No. 16 has been entered.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Canada on 8/1/00. It is noted, however, that applicant still has not filed a certified copy of the 2,314,783 application as required by 35 U.S.C. 119(b).

Drawings

3. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 6/18/03 as part of Paper No. 16, have been approved.

Response to Amendment

4. The cancellation of Claims 1-44, 46-62 in Paper No. 16, dated 6/18/03, is acknowledged and accepted.

5. The amendments to Claim 45 in Paper No. 16, dated 6/18/03, are acknowledged and accepted.

Response to Arguments

6. The Applicants argue that, with respect to newly amended Claim 45, Smith et al. fails to teach or reasonably suggest a high reflectivity micro mirror, the mirror comprising a homogeneous monolithic bulk crystal silicon having an anisotropic body with several crystalline planes. In reviewing the Smith et al. reference, the upper and lower silicon substrates (i.e. 14 and 18 in Figure 2) are separately processed prior to the wafer bonding process which produces the final structure shown in Figure 2. Hence, both the upper and lower silicon substrates are homogeneous, monolithic bulk crystal silicon, and the anisotropically etched mirror 16 of Figure 2 meets the claimed combination as recited in Claim 45. The Applicants further argue the requirements regarding post processing of the structure as shown in Figure 2. However, such post processing requirements are not recited in the claim. The Examiner notes that if the claimed high reflectivity micro mirror is required to be of a single piece, such a limitation should be included.
7. The Applicants argue that, with respect to newly amended Claim 45, Stanley et al. in view of Madou fails to teach or reasonably suggest a high reflectivity micro mirror, the mirror comprising an inlet passage and an outlet passage anisotropically etched independent of crystalline planes, which intersect at the selected one of the several crystalline planes. The Examiner notes that the Applicants' specification fail to disclose the limitation that an inlet passage and an outlet passage be *anisotropically etched*

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independent of crystalline planes. Furthermore, one skilled in the art will realize that anisotropic etching occurs when different directions in the material etch at different rates. The anisotropy of etching stems from the crystal structure of the material, and the shapes realized by such etching are restricted to those that are bounded at least in part by a slowly etching crystal plane. Thus, it is not possible to anisotropically etch a material independent of the crystalline planes of that material.

8. Claim 45 is rejected as follows.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

10. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

11. Claim 45 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 45, as currently amended, recites the limitation of a high reflectivity micro-mirror, comprising in particular an inlet passage and an outlet passage anisotropically etched independent of crystalline planes, which intersect at the selected one of the several

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crystalline planes. The Applicants' disclosure fails to provide support for the inlet passage and outlet passage being anisotropically etched *independent of crystalline planes*. Furthermore, as discussed above, it is not possible to anisotropically etch a material independent of that material's crystalline planes, since by definition, the anisotropy of such an etching process is due to the crystal structure of that material (particularly, atomic packing densities, bond strengths, etc. along different crystal planes).

12. Claim 45 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 45 recites the limitation that a mirror surface be co-extensive with an anisotropically etched portion of a selected one of the several crystalline planes positioned internally within the body. It is unclear whether the mirror or the crystalline planes are to be positioned internally within the body.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Stanley et al. (U.S. Patent No. 5024500 or Stanley '500) in view of Stanley (U.S. Patent No. 4854658

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or Stanley '658) and Madou (M. Madou, "Fundamentals of Microfabrication", CRC Press, Washington, DC, 1997, pp. 148-154).

Stanley '500 discloses a high reflectivity micro mirror (See for example Figures 3-4), comprising a homogeneous monolithic bulk crystal silicon (See 34 in Figure 3) having an anisotropic body (inherently, bulk crystal silicon has an anisotropic body with multiple crystalline planes, each crystalline plane etching at different etch rates due to the differing atom densities and bonding structures of each crystalline planes) with several crystalline planes (in the instant case, the selected crystalline plane is taken to be the plane defined by reflector 38 in Figure 3), and a mirror surface (See 38 in Figure 3) co-extensive with a portion of a selected one of the several crystalline planes, both the mirror and the selected one of the several crystalline planes being positioned internally within the body.

Additionally, Stanley '500 discloses an inlet passage (See for example 300 in Figure 3) and an outlet passage (See for example 301, 302 in Figure 3) that intersect at the selectively exposed portion of the crystalline plane. Stanley '500 lacks the mirror surface being co-extensive with a selectively *anisotropically etched* portion of the crystalline plane and the inlet passage and outlet passage being *anisotropically etched*. However, Stanley '658 similarly teaches a high reflectivity micro mirror (See Figure-2); the mirror including a homogeneous monolithic bulk crystal silicon having an anisotropic body with several crystalline planes (See ¹14 in Figure-2); a mirror surface co-extensive with a selectively exposed portion of the crystalline plane (See ⁶16 in Figure-2); and an inlet passage and an outlet passage (See ²⁻⁴3, 4 in Figure-2) formed by anisotropically etching grooves in the silicon (See col. 2, lines 25-35). Additionally, Madou teaches a method of

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anisotropically etching vertical and angled sidewalls in bulk silicon by properly aligning the mask opening with particular planar orientations of the bulk silicon (See pages 149-153 on a discussion of anisotropic etching of [100]-oriented bulk silicon, and in particular, pages 151-152 and Figures 4.9 and 4.10 with regards to etching vertical (90 deg.) sidewalls and pages 149-151 and Figures 4.7 and 4.8 regarding angled (54.74 deg.) sidewalls). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the mirror surface be co-extensive with a selectively *anisotropically etched* portion of the crystalline plane and the inlet passage and outlet passage being *anisotropically etched*, as taught by Stanley '658 and Madou, in the high reflectivity micro mirror of Stanley '500. One would have been motivated to do this to take advantage of existing lithographic methods for patterning on bulk silicon, as well as existing well-known anisotropic etchants, such as potassium hydroxide (KOH) or tetramethyl ammonium hydroxide (TMAH).


Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arnel C. Lavarias whose telephone number is 703-305-4007. The examiner can normally be reached on M-F 8:30 AM - 5 PM EST.

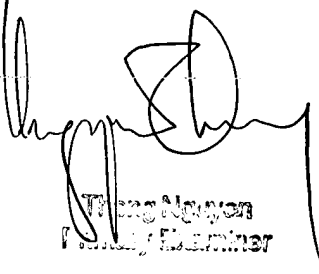
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Drew Dunn can be reached on 703-305-0024. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1782.



Arnel C. Lavarias
July 30, 2003



Thanh Nguyen
Patent Examiner